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Patentanmeldung Nr. | Patent application No. | Demande de brevet n°

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LAMP WITH MERCURY ABSORBING AGENT

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DESCRIPTION

Lamp with mercury absorbing agent

The present invention relates to a lamp containing mercury, e.g. an UHP (Ultrahigh-pressure) lamp.

In present art UHP lamps, it is necessary to use mercury to achieve proper operation of the lamp. Although the amounts used are merely in the range of 10-20 mgs per lamp, there has been a growing concern that in case of an explosion of the lamp, the outside of the lamp might be exposed and contaminated by the mercury. Such explosions can up to date never be avoided, even with the highest standard lamps. The main two reasons for such lamp explosions are:

1.) The explosion takes place when the lifetime of the lamp has nearly ended due blow up because of recrystallisation of the quartz bulb. By monitoring the lamp voltage, these blow-ups can be avoided, if the lamp is turned down, when certain criteria are met. A control device is e.g. disclosed in the EP 1 076 478.
2.) The explosion takes place due to tension in the quartz. This can up to date not be detected and may lead to explosion during any time the bulb is operated.

Since the risk of an explosion of the lamp cannot be eliminated, it must be taken care that the mercury contained inside the lamp is not exposed to the outside, if such an explosion happens. Therefore several attempts have been proposed to deal with this problem:

The EP 1 003 202 discloses a discharge lamp, which employs a higher-pressure and higher-wattage lamp body and is capable of effectively preventing the scattering of broken pieces of the lamp body at explosion of the lamp body. The discharge lamp comprises a lamp body, a reflector having the lamp body, and a front glass fitted on a front portion of the reflector, wherein the reflector has vent holes in which mesh sheets

or perforated plates are fitted. Even if the lamp body explodes, broken pieces of the lamp body do not pass through the holes thereby to be prevented from scattering outside.

Similar devices are disclosed in the EP 1 164 328 and JP 2002216531.

The US 5, 277, 686 discloses a mercury vapor discharge lamp (e.g., a fluorescent lamp) having an envelope containing an inert starting gas and a quantity of elemental mercury at least partially convertible to soluble mercury. Enclosed within the lamp is an amount of chemical agent suitable for chemically combining a substantial portion of the soluble mercury as a sparingly soluble salt when the lamp is pulverized as a result of disposal. In one embodiment, the chemical agent is potassium periodate which is sealed within an enclosure which is rupturable upon pulverization of the lamp. The sealed enclosure may be disposed within the envelope or external to the envelope, such as within a cavity defined by a lamp base. In another embodiment, the chemical agent is mixed with the basing cement used to secure one or more of the lamp bases to the envelope.

The above-described devices still bear the following disadvantages:

The EP 1 003 202, EP 1 164 328, and JP 2002216531 show devices, in which the mercury is hindered to advance upon the outside of the lamp by introducing a pure mechanical object e.g. a glass means, which serves as a barrier. The mercury itself stays unaffected. If a leakage occurs in the glass means, it is free to advance to the outside of the lamp.

The US 5,277,686 shows only a device which is capable of precitipating oxidized mercury (Hg(II)) as an insoluble salt, e.g. as periodate or as sulfide. However, the vast majority of the mercury contained in the burner of the lamp is present as Hg(0) in either metallic liquid or gaseous form and is not affected by the device disclosed in the US 5,277,686 at all. Furthermore, the device is to be used only when the lamp is to be

pulverized, i.e. when it is to be destroyed, whereas the event of an explosion of the lamp is not discussed. This device is therefore only of use during a "controlled" process as the disposal of a lamp, whereas it is not of any use when an unwanted and uncontrollable event such an explosion of the lamp takes place.

It is therefore an object of the present invention to provide a device which is capable of effectively hindering the mercury contained in the lamp to advance to the outside of the lamp in case an explosion happens. It is a further object of the present invention that the mercury inside the lamp is prevented from reacting with other components inside the lamp after an explosion, thereby generating toxic mercury compounds. It is a further object of the present invention to secure that the lamp - although an explosion took place - can nevertheless be disposed.

These objects are achieved by a lamp as disclosed in Claim 1 of the application. This lamp contains a burner with an ionizable filling and an amount of mercury contained therein and is characterized by at least one mercury-absorbing means located outside the burner for the absorption of mercury in case of an explosion of the burner. The mercury-absorbing means is capable of absorbing at least 20%, preferably at least 30%, more preferably at least 50%, even more preferably 60%, yet more preferably 80% and most preferably at least 90% of the mercury contained in the burner after an explosion took place. By this mercury-absorbing agent, the mercury is fixed and bonded to a known region and/or component located inside the lamp. It is furthermore unable to react with further component which may be present inside the lamp. Due to the fixation of the mercury, the lamp may be disposed although an explosion took place.

Preferably the absorption of the mercury is achieved via the formation of an amalgam and the mercury-absorbing means contains at least one mercury-absorbing agent which is adapted to form an amalgam with mercury. It is known that a broad range of elements and alloys readily form amalgams with mercury. In a preferred embodiment of the present invention, the mercury-absorbing agent contains at least one of the elements out

of the group consisting of In, Bi, Zn, Sn, Pb, Ag and Au or mixtures thereof. Preferred mixtures are on the other hand binary alloys of two elements, such as non-limiting examples Bi-In, Pb-Sn, Bi-Pb, Bi-Sn, In-Sn, In-Ag, In-Zn and/or Sn-Zn, or on the other hand ternary and higher alloys such as non limiting examples Bi-Pb-Sn, In-Sn-Ag, In-Sn-Zn, Bi-Pb-Zn, Bi-In-Pb, Bi-Sn-Au, Pb-Sn-Au and/or Pb-Sn-Zn. The content of either one component within the alloys may range from 0 to 100%.

The composition of the mercury absorbing means may be set according to the quantity of mercury to be absorbed, the required absorption speed, the temperature and/or other parameters.

The position of the mercury absorbing agent can be anywhere inside or adjacent to the lamp. In a preferred embodiment, the lamp comprises a reflector room defined by a reflector and a front glass and that the lamp and at least one of the at least one mercury absorbing means is located adjacent to or within the reflector room. The mercury absorbing means is preferably located on the place within the reflector room, which is the coldest, after an explosion occurred, preferably in the vicinity, most preferably in the vicinity of the bottom part of the front glass. In this embodiment, a most effective absorption of the mercury can be achieved, since the gaseous mercury will liquefy predominantly on the coldest spot inside the reflector room.

In an alternative preferred embodiment, especially in case the lamp is cooled by an air or gas stream, the mercury absorbing means is placed in the vicinity of an air or gas outlet, preferably in the air or gas outlet, the air or gas being used to cool the lamp.

In a further preferred embodiment, the lamp comprises an antenna wire and at least a part of the wire comprising a mercury-absorbing means. Most preferably the wire is coated with a mercury-absorbing agent.

In another embodiment at least one of the mercury absorbing-means is formed,

preferably by vacuum deposition as a thin layer on the reflector and/or the front glass. By doing so, a maximum surface of the mercury absorbing means can be achieved.

A mercury absorbing means as described in the present invention is able to absorb 0.2 mg of mercury per minute, preferably 0.5 mg of mercury per minute, more preferably 1 mg of mercury per minute, most preferably 5 mg of mercury per minute

In yet another preferred embodiment, the lamp furthermore comprises ventilator means for cooling the reflector, wherein the ventilator means are turned off immediately after an explosion of the lamp.

Preferably the lamp furthermore comprises detection means which are adapted to detect an explosion of the lamp. This can e.g. be achieved by monitoring of the lamp voltage, which will break down in case of an explosion.

A lamp as described in the invention may be used in various applications, amongst them being shop lighting, home lighting, accent lighting, spot lighting, theater lighting, fiber-optics applications, consumer TV applications, head lamps, fiber-optics applications, and projection systems. Most preferred are consumer TV applications.

This and other advantages of the present invention will become apparent out of the following description with reference to the accompanying figures, wherein

Fig.1 shows a cross-sectional schematic view of a first embodiment of the lamp according to the present invention

Fig. 2 shows a view of the lamp of Fig. 1 as seen from arrow A

Fig 2A shows a detailed view of the mercury absorbing means of Fig. 1 and 2

Fig. 3 shows in an alternative embodiment of the present invention a schematic view of a burner having an antenna means

Fig. 4 shows a cross-sectional schematic view of a second embodiment of the lamp

according to the present invention having a mercury absorbing means placed in an air or gas outlet within the reflector

Fig. 4a shows a detailed view of the mercury absorbing means in Fig. 4.

Figs. 1 and 2 show a lamp 1 according to a first embodiment of the present invention, which comprises a burner 10, a reflector 20, a front glass 30, reflector 20 and front glass 30 defining a reflector room 25, and a mercury-absorbing means 40 located inside the reflector room 25. Burner 10, reflector 20 and front glass 30 may be of standard technique and are not discussed in detail. However, all known types of burner 10, reflector 20 and /or front glass 30 are suitable to be used within the present invention.

Although a preferred burner 10 may have an inner pressure of 250 bar, there will be no significant rise of pressure inside the reflector room 25 when an explosion occurs. Due to the 1000fold higher volume of the reflector room 25 compared to the inner room of the burner, there will be no exposition of the gas inside the reflector room 25 at first, instead the air inside the reflector room 25 will cool down quite fast, thereby causing outside air to flow inside the reflector room 25. This means one the other hand that the mercury contained inside the burner previous to the explosion will stay inside the reflector room for a period of time sufficient to be absorbed by the mercury-absorbing means.

The mercury absorbing means contain at least one mercury absorbing agent, which is capable of absorbing mercury. This is preferably be achieved by forming an amalgam with the mercury. More preferably, the mercury absorbing agent consists of one of the elements out of the group consisting of In, Bi, Zn, Sn, Pb, Ag and Au or mixtures thereof, since these elements are known to readily form amalgams with mercury.

It is noted, that by using a mercury absorbing agent containing at least one element having a proper redox potential, also Hg(II)- and Hg(I)-compounds can be absorbed, since then the mercury is reduced to Hg(0) first. However, the mercury absorbing means

may alternatively or additionally contain mercury absorbing agents, which absorb mercury by precipitation of Hg(I) and Hg (II) e.g. in form of their periodates or sulfides. Furthermore, the mercury absorbing means may also contain zeolithes which are known to absorb mercury. Especially preferred zeolithes are those who have holes or cavities with the size of approximately 3-4 Å.

A mercury absorbing agent which has already proven itself in practice consists of indium, e.g. as a foil or wire. By using this agent, it is possible to absorb 50 % of the mercury contained in the reflector room within 60 Minutes.

Due to the fact that according to the present invention the mercury is bonded and fixed, instead of merely being hindered to leave the reflector room by e.g. a glass frame, there is no need that the lamp itself needs to be air-tight, thereby leaving more room for variation in the design and technical features of the lamp.

Fig. 2A shows a detailed view of the mercury absorbing means 40 used in the first embodiment of the present invention. The mercury absorbing means 40 is in this embodiment a solid body located in the vicinity of the front glass. Preferably the mercury-absorbing means is located on that region inside the reflector room, which is the coolest place after an explosion took place, since the gaseous mercury will preferably liquefy in this region and can then be absorbed in an efficient manner. In present art lamps, the coolest place is in the vicinity of the front glass, approximately in the vicinity of the bottom region thereof.

The mercury absorbing means 40 in the present embodiment comprises a folded metal or steel plate 42, which is coated with an mercury absorbing agent 42. By using the folded metal plate 42, a great surface for absorption of the mercury can be provided. The mercury absorbing plane typically amounts to several square centimeters, preferably as large as possible depending from its positioning within the reflector. The mercury absorbing agent 42 can be fixed to the substrate by a number of standard

techniques comprising e.g. vapor deposition, sputtering or spraying of components.

Fig. 3 shows a schematic view of an alternative embodiment of the present invention comprising a burner 10 with an antenna wire 50. This antenna wire may be coiled around or located in the vicinity of the burner. A device containing such an antenna wire and the purpose of an antenna wire is e.g. shown in the WO 00/77826 A1. In the case, when an antenna wire 50 is used, the antenna wire 50 in an alternative embodiment of the present invention comprises at least one mercury absorbing means, e.g. in the way that the antenna wire 50 is coated with an mercury absorbing agent (not shown in the figs.). Due to the high surface of the antenna wire 50, an efficient absorption of the mercury can be obtained.

Fig. 4 shows a lamp 1' according to a second embodiment of the present invention. This lamp differs from the lamp 1 shown in Fig. 1 in that it is air- or gas-cooled via a stream of air or gas which is directed to flow around the burner 10. In this case it is standard technique that the reflector 20' comprises an in- and outlet for the gas or air. In the case that such a lamp is used, the mercury absorbing means may preferably also contain mercury absorbing agents 40, which are placed in the in- and outlet of the air or gas, as can be seen in Fig. 4. In this case, the mercury absorbing means may comprise an array, on which the mercury absorbing agent is located on, as can best be seen in Fig. 4a. The array itself may consist of a material which merely serves as a basis for the mercury absorbing means which is placed on it or may consist of a mercury absorbing material itself. It is noted, that also mercury absorbing means e.g. in form of a folded strip or other suitable forms may be used.

In a further alternative embodiment of the present invention (not shown in the figs.), the mercury absorbing means and/or the mercury absorbing agent are provided as a thin layer on a part or on the whole of the reflector and/or the front glass. This can e.g. be achieved by vacuum deposition. If the mercury absorbing agent is present inside the reflector room in this way, a maximum surface for mercury absorption is provided, thus

securing that a maximum amount of mercury is absorbed per given period of time.

In a yet further alternative embodiment of the present invention (not shown in the figs.), the mercury absorbing means may be placed not within the reflector room, but in the vicinity of it or adjacent to it, but preferably in a region, where the mercury will leave the reflector room after an explosion of the burner occurred. By this arrangement, a standard lamp may be used while still having an absorption of the mercury.

In some embodiments of the present invention, the reflector may be cooled by ventilation means such as a ventilator (not shown in the figs.). In this case it is preferred that the ventilator means are turned off in case an explosion happens to avoid any turbulences inside the reflector room. An effective turn-off of the ventilator means may be achieved, if the voltage of the burner is monitored. This can e.g. be done by the electronic lamp driver, which may preferably also control the ventilation means, especially turn the ventilation means on and off. In case of explosion, the voltage will break down. By proper detection means, a detection signal may then be sent-off, causing the ventilator means to be turned off.

CLAIMS

1. Lamp (1) comprising a burner (10) with an ionizable filling and an amount of mercury contained therein, having at least one mercury-absorbing means (40) located outside the burner (10) for the absorption of mercury in case of an explosion of the burner (10).

2. The lamp according to claim 1 wherein the absorption is achieved via the formation of an amalgam and wherein the mercury-absorbing means (40) contains at least one mercury-absorbing agent (44) which is adapted to form an amalgam with mercury and/or at least one mercury absorbing agent (44) which is adapted to bind mercury chemically and/or at least one mercury absorbing agent (44) which is a zeolithe adapted to absorb or bind mercury.

3. The lamp according to claim 2, wherein the mercury-absorbing agent (44) contains at least one of the elements out of the group consisting of In, Bi, Zn, Sn, Pb, Ag and Au or mixtures thereof.

4. The lamp according to any of the claims 1 to 3 wherein the lamp furthermore comprises a reflector room (25) defined by a reflector (20) and a front glass (30) and that the burner (10) and at least one of the at least one mercury absorbing means (40) are located adjacent to or within the reflector room (25).

5. The lamp according to claim 4, wherein a mercury absorbing means (40) is located on the place within the reflector room (25) which is the coldest after an explosion occurred, preferably in the vicinity of the front glass, most preferably in the vicinity of the bottom part of the front glass and /or a mercury absorbing means is placed adjacent to or within an in- or outlet for air or gas which is used to cool the lamp.

6. The lamp according to any of the claims 1 to 5, wherein the mercury absorbing means (42) comprise a metal or steel component (42), preferably in the form of a folded strip, which is coated with at least one mercury absorbing agent (44) and/or comprise an array, which forms or is coated with at least one mercury absorbing agent (44).

7. The lamp according to claim 1 to 6, wherein the lamp furthermore comprises a wire (50), at least a part of the wire (50) comprising a mercury-absorbing means, preferably the wire (50) is coated with a mercury-absorbing agent.

8. The lamp according to any of the claims 4 to 7, wherein at least one of the mercury absorbing-means is formed, preferably by vacuum deposition, as a thin layer on the reflector and/or the front glass.

9. The lamp according to any of the claims 1 to 8, furthermore comprising ventilator means for cooling the reflector, wherein the ventilator means are turned off immediately after an explosion of the lamp.

10. A lamp according to one of the claims 1 to 9, being designed for the usage in one of the following applications:

- shop lighting,
- home lighting,
- head lamps
- accent lighting,
- spot lighting,
- theater lighting,
- consumer TV applications,
- fiber-optics applications, and

projection systems.

ABSTRACT

Lamp containing a mercury-absorbing agent

The invention relates to a lamp, e.g. a UHP-Lamp, comprising a burner with an ionizable filling and an amount of mercury contained therein. The lamp furthermore comprises at least one mercury-absorbing means located outside the burner for the absorption of the mercury, in case the burner explodes.

Fig. 1

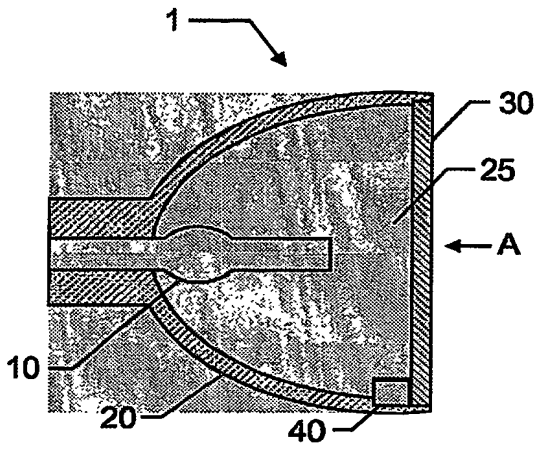

FIG. 1

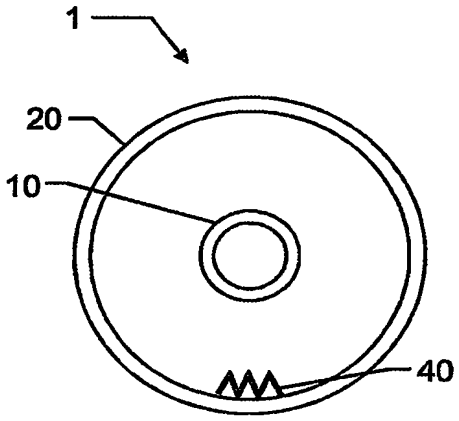

FIG. 2

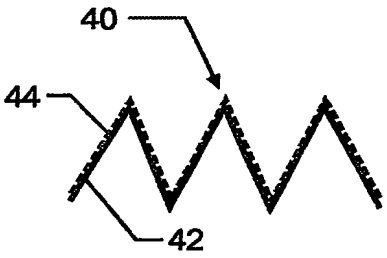

FIG. 2A

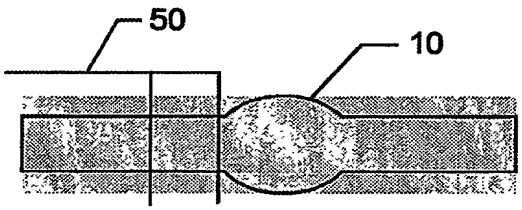

FIG. 3

Fig. 4

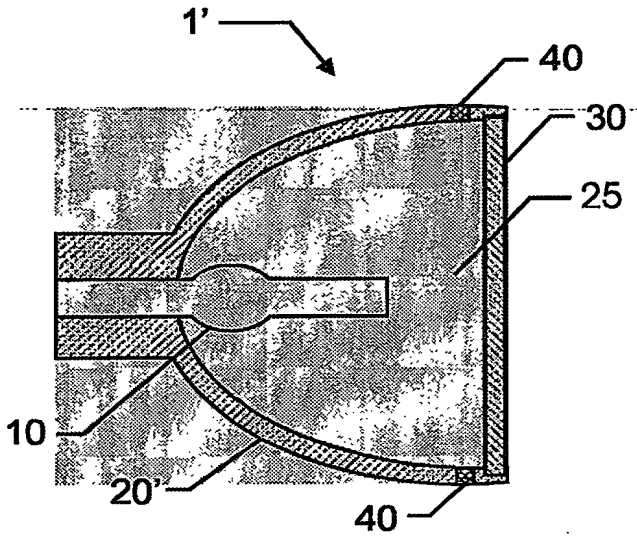

Fig. 4a